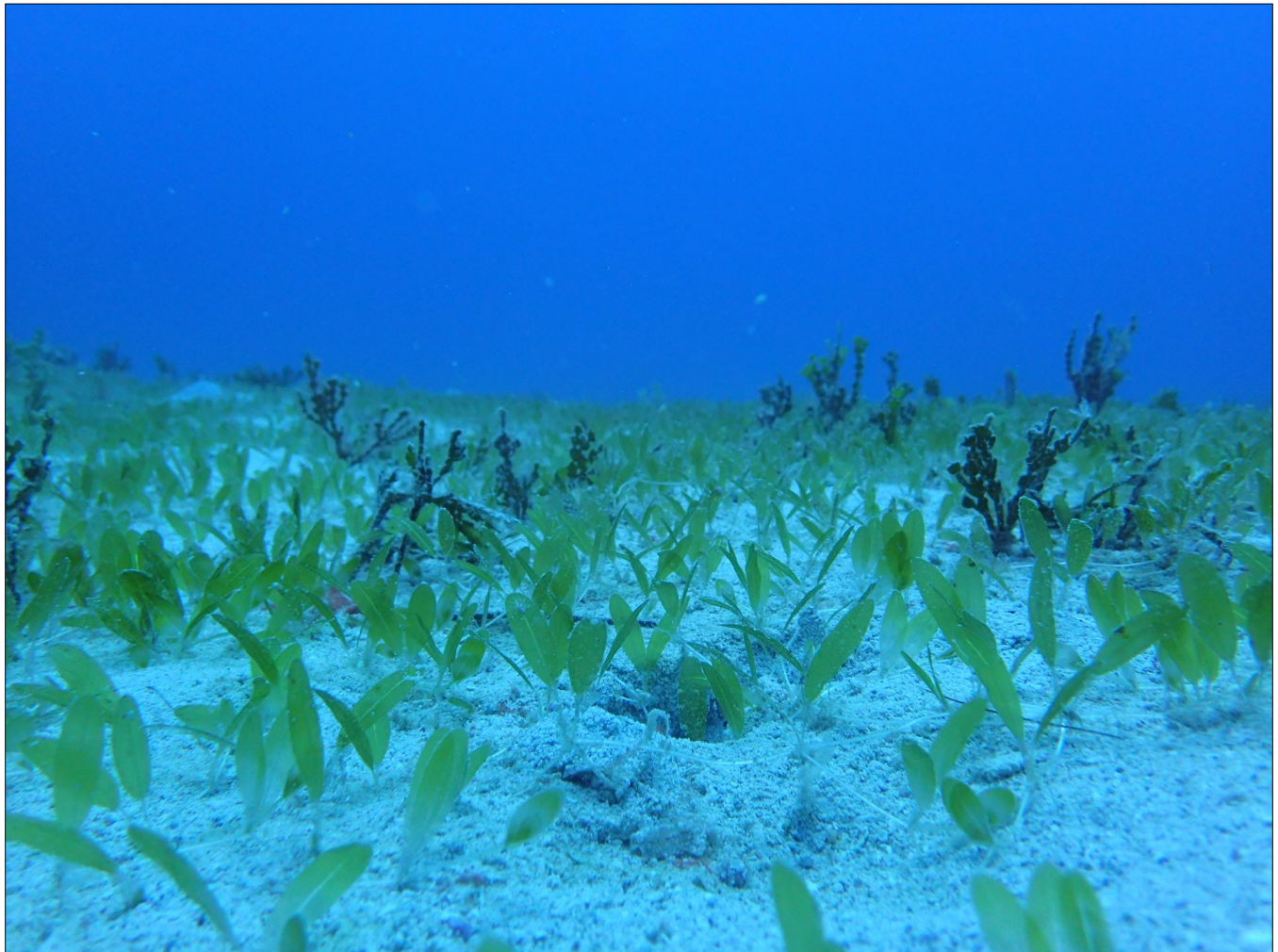




South Florida/Caribbean Network Seagrass Community Monitoring

Data Quality Standards

Natural Resource Report NPS/SFCN/NRR—2019/1903



ON THE COVER

H. decipiens with *Halimeda* sp. at Salt River Bay National Historical Park and Ecological Preserve, canyon floor; photo credit: Jeff Miller, NPS SFCN.

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March 2019

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

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Please cite this publication as:

Davis, A. D., M. W. Feeley, M. Londoño, L. Richter, J. M. Patterson, and A. J. Atkinson. 2019. South Florida/Caribbean Network seagrass community monitoring: Data quality standards. Natural Resource Report NPS/SFCN/NRR—2019/1903. National Park Service, Fort Collins, Colorado.

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Introduction and Summary

The purpose of this report is to document the standards used by the South Florida/Caribbean Network for activities related to the collection, processing, storage, analysis, and publication of monitoring data as described in the *South Florida/Caribbean Network Seagrass Community Monitoring: Protocol Narrative* (Davis et al. 2019a). The policies and procedures documented in this quality-assurance plan for activities complement the quality-assurance plans for other monitoring activities conducted by the South Florida/Caribbean Network and supplement the National Inventory & Monitoring Division Quality Management Plan (in prep). The plan also serves as a guide for all South Florida/Caribbean Network personnel who are involved in protocol/program activities and as a resource for identifying memoranda, publications, and other literature that describe associated techniques and requirements in more detail.

Protocol Overview

Seagrass communities in nearshore coastal ecosystems provide important habitat for numerous species including recreationally and commercially important juvenile fish and invertebrate species, sea turtles, and wading and diving birds. These ecosystems also increase water clarity by reducing the impact of wave energy and helping to stabilize sediments. However, these communities are sensitive to natural and anthropogenic impacts such as eutrophication, pollution, physical damage, and changes in hydrological patterns (Lapointe et al. 1994; Fourqurean et al. 2002). Seven native seagrass species occur inside or in close proximity to seven of the South Florida/Caribbean Network (SFCN) parks. Seagrass communities in SFCN parks have been exposed to significant anthropogenic stress, such as eutrophication and changes in salinity patterns associated with water management in South Florida, among other impacts. More recently, an invasive exotic seagrass species has been responsible for seagrass community changes in the U.S. Virgin Islands.

The South Florida/Caribbean Network is developing monitoring programs for natural resource “vital signs” including seagrass communities within network national parks. As several partners already monitor seagrass communities in and near network parks, the SFCN’s seagrass monitoring is focused on the gaps in existing monitoring programs, including offshore Biscayne National Park, Buck Island Reef National Monument, Salt River National Historical Park and Ecological Preserve, and Virgin Islands National Park. Partners already monitor Biscayne Bay, Florida Bay (in Everglades National Park) and Dry Tortugas National Park.

The primary objective for the SFCN seagrass protocol is to:

- Monitor trends in seagrass cover, community composition and the presence of invasive exotic species within mapped seagrass habitat in network parks.

Secondary objectives for the SFCN seagrass protocol are to:

- Collect ancillary information (e. g., water depth, sediment depth, substrate type, canopy height, *Lobatus gigas* [Queen Conch] count) that can be used to improve understanding of seagrass species and habitat relationships or provide information to support another vital sign.

- When requested by park management and logistically feasible, compare trends in seagrass cover, community composition, and the presence of invasive exotic species within and outside of parks to evaluate the effectiveness of park management actions.
- When requested by park management and logistically feasible, perform additional “episodic” monitoring in response to unforeseen events or circumstances.

Seagrass is monitored using a stratified random approach in which randomly selected sample locations are monitored by teams of divers deploying four 0.25 square meter (2.7 ft²) quadrats which are assessed using a Braun-Blanquet methodology. Sampling in parks will occur in rotation with parks revisited once every three years after a baseline is established.

As extensive seagrass monitoring is already conducted by well-established programs, the network developed the SFCN seagrass monitoring protocol using established methods described in *A Seagrass Monitoring Program for Texas Coastal Waters: Multiscale Integration of Landscape Features with Plant and Water Quality Indicators* (Dunton et al. 2011; also referred to as ‘The Texas Seagrass Protocol’), *Spatial and Temporal Pattern in Seagrass Community Composition and Productivity in South Florida* (Fourqurean et al. 2001), and *Integrating Scales of Seagrass Monitoring to Meet Conservation Needs* (Neckles et al. 2012). The Texas seagrass protocol was itself based on the work by Jim Fourqurean of Florida International University (FIU; Fourqurean et al. 2001) and Neckles et al. (2012), and is currently being used in the Gulf Coast Network (GULN). This SFCN seagrass protocol follows field methods described in the Texas seagrass protocol, while maintaining consistency with the work performed by Florida International University and other regional seagrass monitoring efforts. The SFCN seagrass protocol survey design is based on descriptions in both protocols. Data analysis is based on the Texas seagrass protocol and Fourqurean et al. (2001).

The South Florida/Caribbean Network will generate basic data summary reports and publish the data, making it available to park staff and the scientific community. Results obtained from this monitoring program are expected to fill gaps in the knowledge of seagrass systems in network parks, and also help expand the collective understanding of regional seagrass conditions.

Protocol Activities and Modules

Data are collected or derived as a part of the *South Florida/Caribbean Network Seagrass Community Monitoring: Protocol Narrative* (Davis et al. 2019a) in nine different activities or modules (Table 1).

Table 1. Protocol activity matrix for *South Florida/Caribbean Network Seagrass Community Monitoring: Protocol Narrative* (Davis et al. 2019a).

Activity Type	Activity #	Activity	Description
Site Recon, Establishment, and Maintenance	1	Sampling frame, strata, and site selection	Shapefiles of sampling frame and strata, and number of sites sampled each year are documented. Sites are re-randomized during each sampling event. Sites are visited once. No physical markers are left in the field
Field Observations	2	Site-level Data	At each site, site level data are recorded, including location, current, visibility, water depth, seagrass species present and habitat classification
	3	Submerged Aquatic Vegetation Quadrats	Within 0.25 m ² quadrats the following are recorded: Braun-Blanquet scores recorded for seagrass by species and for all species; Braun-Blanquet scores recorded for algae by genus or taxonomic group; seagrass canopy height; sediment depth; sediment type
	4	Queen Conch counts	One count per site of number of Queen Conch within a radius of 7.5 m and record whether majority are adult or juvenile
Sensor Data	5	Site Characterization Photos	Photos taken in four general cardinal directions plus one of datasheet
	6	Quadrat Photos	Photos taken of each quadrat
Derived Data	7	Cover class	Average Braun-Blanquet score by total seagrass, seagrass species and algal genus, calculated for each stratum and for mapped seagrass areas within each park
	8	Frequency	Proportion of quadrats at each site with seagrass species or algae taxa present, calculated for each stratum and for mapped seagrass areas within each park
	9	Native Species Richness	Average number of native seagrass species detected per site, calculated for each stratum and for mapped seagrass areas within each park

Sampling Design

Information regarding the sampling design is provided in Table 2.

Table 2. Activity-level sample design matrix for *South Florida/Caribbean Network Seagrass Community Monitoring: Protocol Narrative* (Davis et al. 2019a).

Activity #	Activity	Sampling Design	Revisit Design
2	Site-level Data	Probability; stratified random design across all mapped seagrass within sample frame, which excludes areas that are not safe to sample. BISC: Sample frame is offshore mapped seagrass habitat with exception of areas within the channel markers of Caesar's Creek and the Biscayne Channel as well as east of Lewis Cut are excluded for safety reasons BUIS: Sample frame is all mapped seagrass habitat. VIIS: Sample frame is all mapped seagrass habitat with exception of Cruz Bay. SARI: Sample frame is all mapped seagrass habitat in the offshore canyon of the preserve.	Re-randomized sample every 3 rd year. Parks visited in rotation: VIIS (Year 1), BUIS and SARI (Year 2), and BISC (Year 3).
3	Submerged Aquatic Vegetation Quadrats	Sites are identified as in Activity 2. At each site, four quadrats are haphazardly placed and sampled.	Same as Activity 2
4	Queen Conch counts	Sites are identified as in Activity 2. At each site, a 7.5 m radius area originating from the reel and buoy (deployed at the site) is sampled.	Same as Activity 2
5	Site Characterization Photos	Same as Activity 2	Same as Activity 2
6	Quadrat Photos	Same as Activity 3	Same as Activity 2

Data Quality Objectives

Data quality values and standards for implementation are provided in Table 3 through Table 6.

Table 3. Data quality values for *South Florida/Caribbean Network Seagrass Community Monitoring: Protocol Narrative* (Davis et al. 2019a).

Data Quality Type	Data Quality Value	Definition	Protocol Considerations
Intrinsic Data Quality	Accuracy	Measurements reflect the true value of the parameter being observed. This applies to measures (length, width, position) or classes (species, types, or categories). Includes components of precision and bias.	Before each sampling season, seagrass project leader will conduct a training session for surveyors in office followed by in-field training in order to standardize Braun-Blanquet scoring, species identification, and other measures. All seagrasses are properly identified to the species level for all observations. All macroalgae are identified to taxonomic group for all observations.
	Representativeness	Measurements represent conditions at the time of sampling. Combined with accuracy, leads to repeatable data collection.	Sample sites are randomly selected within the sample frame. Placement of quadrats is haphazard but conducted without respect to seagrass. Although they are not randomly placed, the quadrat data are representative of seagrass at the sites.
Contextual Data Quality	Comparability	The degree to which data can be compared among sample locations, data sources, or periods of time.	All sample locations are monitored following the schedule and methods outlined within Davis et al. (2019a).
	Timeliness / Currency	How recent the data need to be to be considered valid for their intended use. Data represents conditions and/or is available and in a format for use at the appropriate time in the decision-making process.	Data entry occurs immediately after field sampling. Annual resource briefs are produced based on initial review of the data, and a more intensive natural resource report is produced every 6 years, as described in Davis et al. (2019a).
	Completeness	All data/ measures required to evaluate accuracy representativeness are present; incomplete data sets (either at a location, across sampling locations, or over time) lose utility or relevance. Data records contain values as planned across the period of record.	Sample sites are re-selected and re-randomized each sample year. All sampling locations are monitored following the methods described in Davis et al. (2019a). Data summaries and analyses being used can adjust for and/or are robust to occasional missing data.

Table 3 (continued). Data quality values for South Florida/Caribbean Network Seagrass Community Monitoring: Protocol Narrative (Davis et al. 2019a).

Data Quality Type	Data Quality Value	Definition	Protocol Considerations
Representational Data Quality	Consistent Representation	Use of standard definitions when describing data quality or resource quality based on data	Data quality is defined as “fit for analysis” or “not fit for analysis.” Data collection occurs during similar dates each year to reduce effect of seasonal variation on data collection.
Data Accessibility	Secure	Access to data, products, and systems limited to appropriate audiences.	All certified (QA/QCed) data and products generated from this monitoring effort will be available to the public via IRMA and NPStoret, except for Queen Conch. Permission for release can be granted only by individual park managers for any Queen Conch-related location data

Table 4. Measurement Quality Objectives for *South Florida/Caribbean Network Seagrass Community Monitoring: Protocol Narrative* (Davis et al. 2019a).

Measure	Quality Indicator	Quality Objective
Site-level data	Location accuracy	± 4m of established waypoint (accuracy of GPS unit).
	Water depth	± 1 m
	Current	100% accuracy (None, moderate, strong)
	Visibility	± 5 m
	Taxonomic resolution	Identifications made to the species level for seagrass and genus or phylum level for macroalgae
	Identification accuracy	95% accuracy for visual observations
	Identification completeness	95% of observations of seagrass made to species level and macroalgae to genus or phylum level
	Habitat classification	95% accuracy for visual observations
Submerged Aquatic Vegetation Quadrats	Taxonomic resolution	Identifications made to the species level for seagrass and genus or phylum level for macroalgae
	Identification accuracy	95% accuracy for visual observations
	Identification completeness	95% of observations of seagrass made to species level and macroalgae to genus or phylum level
	Braun-Blanquet density estimate	Within 1 Braun-Blanquet score
	Seagrass canopy height	± 10%
	Sediment depth	± 5 cm up to a maximum measured depth of 1 meter
Queen Conch Counts	Counts	± 10% of count
	Taxonomic resolution	100% Identifications made to the species level
	Identification accuracy	95% accuracy for visual observations
	Adult versus juvenile accuracy	95% accuracy for visual observations
Site Characterization Photos	Image resolution	Minimum 5 megapixel
	Image format	JPG

Table 5. Taxonomic standards to be used in *South Florida/Caribbean Network Seagrass Community Monitoring: Protocol Narrative* (Davis et al. 2019a).

Activity Type	Activity #	Activity	Standard to be Used	Reference / Authority
Collection of Observational Data	2	Habitat classification	Scientific Publication	System of Classification of Habitats in Estuarine and Marine Environments (Madley et al. 2002); Methods Used to Map the Benthic Habitats of Puerto Rico and the U.S. Virgin Islands (Kendall et al. 2001)
	3	Submerged Aquatic Vegetation Quadrats	Scientific Publication	Caribbean Reef Plants (Littler & Littler 2000)
	4	Queen Conch	Scientific Publication	Reef Creature Identification (Humann et al. 2013)
Reporting of Observational Data	2	Habitat classification	Scientific Publication	System of Classification of Habitats in Estuarine and Marine Environments (Madley et al. 2002); Methods Used to Map the Benthic Habitats of Puerto Rico on the U.S. Virgin Islands (Kendall et al. 2001)
	3	Submerged Aquatic Vegetation Quadrats	Scientific Publication	Caribbean Reef Plants (Littler & Littler 2000)
	4	Queen Conch	Scientific Publication	Reef Creature Identification (Humann et al. 2013)

Table 6. Data Protection standards for *South Florida/Caribbean Network Seagrass Community Monitoring: Protocol Narrative* (Davis et al. 2019a). With the exceptions noted, all data collected are to be made publicly available in a timely fashion.

Data Type	Data Description	Level of Protection	Rules for Dissemination
Location Data and Information	Raw and Provisional Data	Operationally protected	Provided upon request only
	Queen Conch locations	Legally Protected	All location data redacted
Personally Identifiable Information	Non-NPS Staff Information	Legally Protected	All but first name and last initial redacted from public release

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NPS 910/151176, March 2019

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